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January 13, 2003

The Honorable Michael K. Powell
Chairman
Federal Communications Commission
445 12th Street, S.W.
Washington, DC 20554

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FEDERAL COMMUNICATIONS COMMISSION
OFFICE OF THE SECRETARY

Re: Iridium Spectrum Report; *Ex Parte* Presentation in IB 01-185.

Dear Chairman Powell:

Pursuant to your office's request, Iridium is herewith submitting information concerning its current and future spectrum capacity challenges. The data provided in the attached spectrum engineering report provides compelling evidence of the pressing need for the Federal Communications Commission ("FCC" or "Commission") to address the outdated Big LEO band plan generally and to allocate immediately an additional six MHz of spectrum to meet Iridium's growing customer needs. In addition, the spectrum engineering report documents that Iridium could not provide ancillary terrestrial services (ATC) within its limited 5.15 MHz of unpaired spectrum, but that ATC services would be quickly added to Iridium's customer offerings if the spectrum available for its Big LEO service is increased as proposed.

Specifically, the Iridium Spectrum Report and prior *ex parte* filings in this docket provide the following facts for the Commission's consideration:

Iridium Has a Pressing Need for Additional MSS Spectrum. Iridium is an MSS success story that needs additional spectrum to continue that success. Iridium's system use globally has been growing at very rapid rate with some regions experiencing growth as high as 2500% per annum. Department of Defense ("DOD") subscriber growth has been 650% over the past 24 months. In supporting DOD needs, services to regions such as the Middle East have spiked at times to near system capacity levels. These important demands will continue as, just last month, DOD extended its contract with Iridium to call for unlimited airtime use for 20,000 of its personnel. Similarly, Western U.S. and Alaska regional service has increased 380% with peak uses in summer months rising to near capacity levels. With anticipated successes in expanding services to existing and other global, regional and rural customers, the trend in growth should continue assuming adequate spectrum is available to support high quality services.

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The Critical Nature of Iridium's Service Requires Levels of Reliability and Performance Greater than Other Services. In contrast to other services, Iridium's customers must have the highest possible levels of service reliability and performance. The typical Iridium customer needs phone service in areas or conditions under which traditional telecommunications services are not available or dependable. Real world examples are the U.S. military operating in critical conditions, workers or visitors in remote parts of Alaska, and everything from rural communities in the U.S. to tribal villages in Africa. A common theme is that none of these customers can afford to have congestion, blocked calls or service interruptions in using their Iridium services.

Iridium Has Established High Network Standards to Ensure that Its Customers Needs Are Being Met. In effect, Iridium must design and operate its system to handle peak uses that are often regional in nature. Its satellite system must be able to accommodate intense uses for limited periods of time on a frequently regionally concentrated basis. This imposes challenges that become increasingly acute as Iridium's customer base and customer minutes of use grow over time.

Iridium's Big LEO System Is Facing Spectrum Shortage Challenges for Its Critical Needs Users. The attached Spectrum Report documents that the Iridium system is already experiencing a significant number of days per year where usage is over 80% of capacity. This is significant because at the 80% plus mark, the system begins to experience service interruptions and blocked calls. Indeed, the Spectrum Report shows that Iridium projects that the 80% capacity level will be exceeded for over 300 days in 2003 in a variety of regions, absent additional spectrum. The number of regions experiencing 80% capacity utilization on a given day will also increase.

The Spectrum Band Plans Previously Submitted to the Commission Would Address Iridium's Big LEO Spectrum Challenges. In its prior filings in this docket, Iridium proposed two alternative band plans to remedy current spectrum imbalances in the Big LEO service and to ensure a sound and competitive framework for Big LEO service providers in the future. The proposals call for assignment of an additional 6 MHz of spectrum to Iridium for two reasons: (1) 6 MHz is needed to accommodate current and anticipated Big LEO service needs; and, (2) the Iridium system was originally designed for at least a 10.5 MHz spectrum allocation, which means that Iridium rapidly and efficiently could utilize expanded available spectrum.

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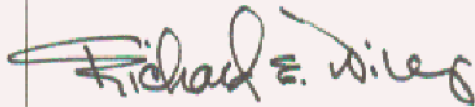
Additional Spectrum Is Required for Iridium to Provide ATC Services. The attached Spectrum Report also confirms that Iridium cannot provide ATC within its existing 5.15 MHz spectrum allocation. There is no technically sound way to offer commercial terrestrial and satellite services with the limited spectrum available while maintaining required system availability. Simply stated, Iridium – one of only two Big LEO providers – would not be able to take advantage of such spectrum flexibility. With additional spectrum, Iridium can promptly move forward to offer ATC. The Iridium system is readily adaptable to exploit such flexible

An FCC Decision to Allow One Big LEO Provider (GlobalStar) to Offer ATC Immediately While Leaving the Only Other Big LEO Provider (Iridium) Unable to Offer ATC Would Irrevocably Doom Competition. There are only two Big LEO service providers. A competitive industry structure obviously cannot persist if the FCC gives one competitor the immediate ability to provide ATC while the other competitor is asked to wait at the starting blocks for an unspecified amount of time with no certainty as to the outcome. Capital markets and customers will recognize the obvious inequity. Simply stated, sound spectrum management requires the Commission to address outdated spectrum band plans before – not after – ATC rights are implemented.

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Pursuant to Section 1.1206 of the FCC's rules, an original and one copy of this written presentation is being filed with the Commission's Secretary for inclusion in IB Docket No. 01-185. Please do not hesitate to contact me with any questions.

Respectfully submitted,



Richard E. Wiley
Counsel to Iridium Satellite LLC

cc (by hand delivery): Marlene H. Dortch, Secretary
cc (by email): Commissioner Kathleen Abernathy
Commissioner Kevin Martin
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IRIDIUM SATELLITE LLC SPECTRUM REPORT

Prepared by Mark Adams
Chief Technology Officer

Monday, January 13, 2003
IB Docket No. 01-185

1.0 Iridium and Its Spectrum Needs

Iridium Satellite LLC (Iridium) operates a global, mobile satellite system offering paging, voice and data communications. Since acquiring the assets of bankrupt Iridium LLC in December 2000 and launching commercial service in March 2001, Iridium has developed a successful business strategy that targets customers in rural and remote areas in the United States and globally. These general public and government customers have significant needs that cannot be met by any other communications systems and require an extremely high level of service reliability. As a result, demand for the Iridium satellite system is growing rapidly with system growth on a global basis of over 350% and regional usage growth as high as 25 fold experienced from 2001 to 2002. In the Western U.S./Alaska region, usage increased by 380% from May 2001 – May 2002. In addition, U.S. Government usage of Iridium services has seen dramatic increases with 10 fold growth during the past two years. Iridium anticipates this growth to accelerate as concentrated regional/rural programs continue to be introduced much along the same growth trends as it has experienced in other areas of the world.

2.0 Purpose of Iridium Spectrum Report

This Spectrum Report responds to the FCC's request for information on Iridium's spectrum requirements. It supplements Iridium's July 2002 petition for additional spectrum to be used for its mobile satellite service (MSS). This report describes Iridium's customers and their communications requirements and then reviews system capabilities and system usage. Against this background, the report provides an analysis of Iridium's spectrum requirements for MSS and confirms Iridium's ability to utilize rapidly additional spectrum to meet its MSS customers' needs. It concludes with an analysis of spectrum use for ATC and an unequivocal demonstration that the Iridium TDMA network can be readily modified to support ATC with the provision of additional spectrum.

3.0 Iridium Customers and Customer Requirements

The U.S. Department of Defense (DOD) subscribes to the Iridium system for essential global mobile secure handheld communications services. Iridium network use by the DOD has experienced greater than 650% subscriber growth over the past 24 months with the subscriber level rapidly approaching the 20,000 base subscriber level in its recently extended contract. Its monthly minute usage has grown by a factor of ten (over 1000%) in the past 24 months. Key features of the Iridium handset (small, lightweight and secure) have made it ideal for DOD emergency operations when speed, mobility and secure connectivity are required. The regions of interest to the DOD often need to be supported with little warning or preparation. During the last twelve months, several regional operations occurred within areas that also had extensive commercial usage. The combined usage levels on the Iridium system exceeded 70% of the system capacity during several of these events. While these operations were fortunately not degraded, it is important to note that these levels occurred within the first two years of

DOD/commercial Iridium service and are likely to increase. While much of the DOD traffic is supported by the DOD gateway, there are several critical operations supported using Iridium cut-through communications services. These handset-to-handset services impact the in-theater capacity as well as the Iridium capacity in the United States since many of these receiving handsets are located in command centers in the United States.

In addition, Iridium is a critical thread in the communicationstapestry throughout Alaska, which has many remote areas and sparse terrestrial connectivity. In Alaska, private aircraft, remote industrial applications, fisherman, and the general rural populace are increasingly relying upon Iridium for vital communications services. The service is also ideally suited for U.S. industrial applications such as heavy construction, defense/military, emergency services, maritime, mining, forestry, oil and gas and aviation.

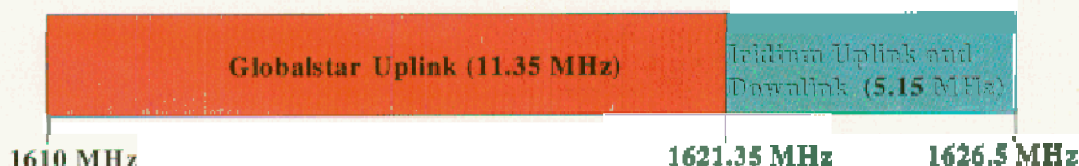
Iridium is also emerging as a viable service to connect rural African communities with their neighbors and the world. In nations such as Angola, Nigeria, Guinea, and Sierra Leone, Iridium is experiencing a substantial growth in demand. Additionally, Iridium has recently commenced service in remote areas of Senegal, Australia and Israel, with planned expansion into Malaysia, Papua New Guinea, and Equatorial Guinea. Critical rural services include health care, education, emergency communications from small villages, public safety, routine governmental and civic exchanges, industrial communications and monitoring, and manufacturing. These rural services place serious demands on system capacity,

4.0 System Capabilities

As depicted below, the FCC has allocated 33 MHz of spectrum in the 1.6 GHz and 2.4 GHz bands to MSS. The Iridium satellite system currently operates in 5.15 MHz of unpaired spectrum in the 1.6 GHz band. Iridium uses 4.8 MHz of spectrum for voice, data and paging traffic. The remaining 0.35 MHz spectrum assigned to Iridium is not usable for communications traffic because it is needed to protect against system self-interference and for overhead requirements (enabling seamless handoffs between satellites, satellite beams, timing and synchronization of the Iridium network).

BIG LEO BANDS Allocations and Assignments

1.6 GHz Band



2.4 GHz Band



The CDMA uplink and downlink spectrum was to be shared among Globalstar, Constellation, Odyssey and Ellipso, however, only Globalstar remains,

5.0 System Usage

The system usage characteristics of the Iridium network vary greatly from a typical mobile environment. For example, users of the Iridium network are clustered in particular regions frequently where no other telecommunications services are available, Iridium's traffic is also seasonal or event driven, leading to peaks that occur in small geographic areas. As a result, the system capacity must accommodate peak loading in these specialized regions without a reduction in service reliability. This is driven by user requirements not system design and is particularly critical given that the missions of many of the current Iridium users' (including emergency workers, military users, search and rescue personnel, etc) are life critical and demand highly reliable mobile communications.

Iridium has also experienced increased use of its handset-to-handset service and has been required to allot a growing amount of spectrum capacity to this service. Handset-to-handset service is made possible due to Iridium's processing-satellite technology and unique "cut-through" service, which allow Iridium to provide regional services independent of any existing local infrastructure (including local PSTN services or regional gateways). Each handset-to-handset call requires twice as much spectrum as a call connected via a regional gateway. This is because two satellite channels are required to complete the call—one for the handset-to-satellite uplink and another for the satellite-to-handset downlink. In addition, the volume of handset-to-handset calls has been increasing. In particular, Iridium

customers in rural and isolated environments where access to other telecommunications infrastructure may not be available have been making extensive use of this feature.

The Iridium network has also been experiencing greater data usage. Iridium began making available data services in addition to voice communications in June 2001. Since that time, data service has been growing in popularity at a much more rapid rate than demand for voice services. In fact, data communications growth over the past two years has been consistently higher than voice growth and currently account for 30 percent of traffic on the satellite system. Data communications services strain system capacity much more than typical voice communications due to their packet-based nature. Analysis of Iridium's network also reveals that subscribers who use data on average use 5 times more call minutes than do typical voice subscribers. The data use is typically clustered around particular times of day within a region.

6.0 Analysis of Spectrum Requirements for MSS

Iridium monitors both system performance and usage to ensure high quality service. System performance is characterized using call establishment and call drop rates. Call establishment rate refers to the number of successful calls established over the total number of mobile call attempts. The call drop rate refers to the unintended disconnection of mobile calls during a pre-determined call-holding period. The nominal call establishment rate for Iridium is greater than 98% with a call drop rate of less than 2% for a call hold time of three minutes. This nominal performance is measured and monitored with unobstructed views of the satellite constellation. Global traffic data on all users indicate that nominal "real world" environment factors result in a typical call drop rate of 5% - 7%. The system call drop rate becomes pronounced when the satellite traffic exceeds 80% system capacity utilization with resulting call drop rates of 25% or greater. This call drop rate can be reduced with additional spectrum that eliminates system inefficiencies.

Iridium's call establishment rate is similarly negatively affected when satellite traffic loading exceeds 80%. While the system is not able to track these failed call attempts since they are never recorded within the Iridium system, this condition is substantiated from affected users. Exacerbating these conditions, at 80% system capacity utilization, it can be expected that the system will quickly reach maximum loading at which point no additional calls would be established.

Iridium's past and predicted future system usage shows a need for additional spectrum to ensure continued high quality service. To evaluate system usage, Iridium compiled actual call traffic data (by day) over the past two years for all regions globally. This data was evaluated to select an appropriate call distribution representative for the constellation. The resulting call distribution was then analyzed for the resulting level of capacity compared with the total regional capacity provided by the system. Finally, Iridium compared several

representative regions with system loading data recorded by the global satellite system to verify statistical accuracy and validate the traffic profile assumptions.

The global and regional tables below summarize the episodic usage experienced to date and project peak activity for 2003. Peak conditions currently vary by event and by day with a nominal peak duration of 15-30 minutes. These peak durations will expand as the number of subscribers and total system usage increase. As presented in Table 1, 80% or greater peak utilization occurred in at least one region in 9 days in 2001, but in 200 days in 2002 with more than 330 days projected in 2003.

Table 1: Global System Capacity Utilization

<i>Global System Capacity Utilization (days)</i>			
	<i>2001</i>	<i>2002</i>	<i>Est. 2003</i>
80% or greater	9	200	330+
60% or greater	9	255	330+
40% or greater	70	330	330+

Table 2: Regional System Capacity Utilization

Eastern United States (days)			
	<i>2001</i>	<i>2002</i>	<i>Est. 2003</i>
80% or greater	-	-	2
50% or greater	-	8	300+
40% or greater	7	179	300+
Western United States (days)			
	<i>2001</i>	<i>2002</i>	<i>Est. 2003</i>
80% or greater	-	-	51
50% or greater	1	87	300+
40% or greater	47	261	300+
Middle East (days)			
	<i>2001</i>	<i>2002</i>	<i>Est. 2003</i>
80% or greater	9	200	300+
60% or greater	9	240	300+
40% or greater	16	300+	300+
30% or greater	30	300+	300+

Africa (days)			
	2001	2002	Est. 2003
80% or greater	-	-	25
60% or greater	-	-	11
40% or greater	-	25	242
20% or greater	4	113	300+

This analysis demonstrates Iridium's need for the FCC to assign it additional spectrum. Additional spectrum is required to ensure high quality services both in the U.S. and globally as is demonstrated by the increased congestion that Iridium is beginning to experience in certain regions of its network and due to the technical system parameters of the Iridium constellation. Table 2 above demonstrates that the regional congestion trends will continue to increase in 2003, without access to additional spectrum. In a variety of regions, satellite loading is approaching 80% for a number of days, leading to the pair of adverse system problems detailed above: call dropping and reduced call establishment. Even without ATC driving spectrum demands even higher, the current Iridium growth trends demonstrate that additional spectrum must be provided to ensure that its critical customer needs are satisfied in a seamless fashion.

As these capacity conditions have become more pronounced, Iridium has had an aggressive effort to maximize system capacity with the available spectrum. Satellite software modifications and gateway software enhancements have been completed and introduced maximizing use of the available spectrum. Enhancements have included power control refinements, satellite access and handoff algorithm enhancements as well as the introduction of low bandwidth messaging services. By this effort, Iridium has exhausted its ability to maximize system capacity through software enhancements. Additional spectrum is required for Iridium to increase further its system capacity.

7.0 FCC Approval Required for Use of Additional Spectrum

Use of additional spectrum by the Iridium system requires approval from the FCC. Iridium's current constellation utilizes the exact same spectrum bandwidth and frequency bands regardless of whether the satellite footprint covers the United States or some other part of the globe. This means that any changes to the spectrum used by the system would have to be implemented globally and thus approved by the FCC. Even if it were technically possible, Iridium could not use additional spectrum to serve foreign countries without the approval of the United States, which licensed the satellite system and is responsible for its coordination globally.

8.0 Utilization of Additional Spectrum

Iridium could quickly utilize any additional spectrum assignment. The software modifications necessary to leverage additional bandwidth can be accomplished within weeks allowing critical needs of both commercial and military to be supported immediately. Since the Iridium network has been designed to support 10.5 MHz of spectrum, minor configuration changes will allow the system to immediately support the additional spectrum. These changes include loading new frequency tables in the satellite constellation updating the terrestrial Iridium gateway databases and allocation tables. These changes can be completed and tested allowing full use of the additional spectrum within weeks.

The assignment of an additional 6 MHz of spectrum to Iridium will more than double the traffic capacity on the Iridium system. The Iridium system was designed to utilize 10.5 MHz of spectrum. That amount of spectrum represents an effective and efficient use of spectrum by the Iridium satellite system. Iridium's commencement of service with less spectrum has resulted in specific system inefficiencies with respect to satellite frequency reuse, intra and inter-satellite handoffs, satellite beam handoffs, and user/satellite access schemes. As system traffic exceeds 80% of capacity, carrier to interferer ratios (C/I) are impacted more significantly, which in turn gives rise to additional system self-interference. The assignment of at least 10.5 MHz of spectrum to Iridium will help eliminate these system inefficiencies and increase system capacity to a larger extent than represented by the spectrum increase alone.

9.0 Analysis of Spectrum Use for Ancillary Terrestrial Services (ATC)

In light of the Commission's stated intention of allowing ATC services within the Big LEO band, Iridium has initiated a series of technical evaluations on how it could make use of these services. Iridium has determined that the current 5.15 MHz of spectrum available for Iridium is insufficient for providing both satellite and ATC services in a commercially viable manner. As shown above, Iridium is experiencing spectrum congestion in a variety of areas without ATC capabilities.

The added functionality inherent in ATC services cannot be realized in the same 5.15 MHz already congested with MSS traffic.

At least 10 MHz of spectrum is necessary to offer MSS and truly ancillary terrestrial service because the provision of ATC requires significant satellite/terrestrial coordination and places additional demands upon the available spectrum. First, the deployment of a terrestrial network in the same spectrum as the satellite system will cause additional interference from the ground base stations to the end user handsets. Harmful self-interference will be extremely problematic without sufficient spectrum to ensure proper frequency coordination between terrestrial base stations and end user handsets. Second, any MSS provider with significant MSS system loading will be unable to provide a viable satellite/ATC service without access to at least 10 MHz of spectrum for system operations as well as for network overhead.

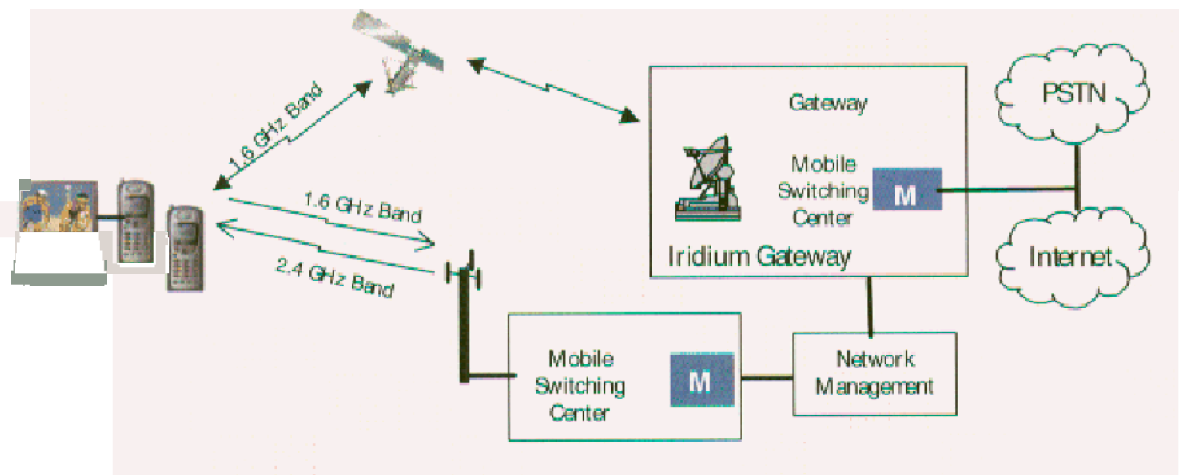
Iridium's constellation flexibility can be leveraged to provide for highly efficient ATC operation in conjunction with the Iridium network. The Iridium processing satellites provide a high level of flexibility achieved by extensive on board software/firmware. The satellite constellation consists of 66 operational satellites arranged in 6 orbital planes of 11 satellites. Each satellite supports four way cross-linking, allowing continuous communications with each satellite neighbor, the ground control system and the communications gateway. Each satellite continuously communicates with all satellite neighbors to ensure proper frequency coordination in orbit, manage proper subscriber satellite handoff and to ensure seamless ground coverage is maintained,

The Iridium ATC system could be a terrestrial system fully integrated with this existing satellite constellation. A central Network Management function could coordinate allocation of system resources and allow for efficient sharing of uplink frequency bands. While there are several approaches involving varying levels of system integration, all include utilizing the Iridium uplink band at 1.6 GHz for both the satellite and ATC segments. Augmented satellite functionality would add terrestrial segments into the dynamic uplink band sharing operation to coordinate satellite/terrestrial frequency assignments and efficiently allocate the needed bandwidth between the satellite and terrestrial segments. In addition, enhanced system functionality would add ATC base stations to satellite near-neighbors and employ Iridium gateway (or telemetry, tracking and command plus PSTN as communications infrastructure) to provide near-neighbor communications between the satellites and ATC components,

Iridium technically could provide the end user with a mobile handheld terminal that would operate in multi-mode fashion, allowing the user access to the satellite and terrestrial portions of the system with a single phone. Depending on available signal strength, capacity resources, and user preference, the phone and/or Network Management would make decisions about whether to serve the user by the satellite or terrestrial portion of the system.

Iridium would be in a position to offer terrestrial connectivity while continuing to provide mobile satellite services with sufficient additional spectrum at either the 1.6 GHz or 2.4 GHz band.

Additional spectrum at 2.4 GHz would provide Iridium paired spectrum. The availability of paired spectrum would permit Iridium more flexibility in signaling and result in more efficient spectrum use. For example, in the future, Iridium could downlink its satellite signal with 2.4 GHz spectrum and thus allowing for only interference and timing mediation for the 1.6 GHz band for the uplink path. Additionally, additional spectrum at 2.4 GHz would permit independent timing in the terrestrial network because voice/data could be sent and received at the same time due to frequency separation between the 1.6 GHz band and 2.4 GHz band,



Additional spectrum at 1.6 GHz only, can be supported by utilizing a time division duplex approach as a portion of the system approach to prevent channel interference within the single block of spectrum available for the signal uplink and downlink. Today, the Iridium system manages a cross-linked network of 66 satellites continuously coordinating 48 spot beams per satellite along with the many spot beams of each adjacent satellites moving with relative speeds up to 32,000 miles per hour. The efficient handling of these challenging conditions required the Iridium system design to be extremely capable and flexible. Leveraging this inherent system flexibility, Iridium can incorporate effective and spectrally efficient ATC services as long as it is provided sufficient spectrum.

